



GCE AS MARKING SCHEME

SUMMER 2018

**AS (NEW)
DESIGN AND TECHNOLOGY - UNIT 1
PRODUCT DESIGN
2603U10-1**

INTRODUCTION

This marking scheme was used by WJEC for the 2018 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

WJEC GCE AS DESIGN AND TECHNOLOGY

UNIT 1 PRODUCT DESIGN

MARK SCHEME SUMMER 2018

Q1	Computer Aided Design/Computer Aided Manufacture (CAD/CAM) is a common method of designing and manufacturing products used by many companies.			
		AO3	AO4	Mark
(a)	Explain the basic principle used by the two CAM machines named below.		✓	4
	<p>Each response must have a brief explanation of the CAM process.</p> <p>Guidance to markers</p> <p>Incorrect/no response. 0 Mark</p> <p>Brief explanation of process. 1 Mark</p> <p>Detailed explanation of processes. 2 Marks</p> <p>Example: Laser cutter/engraver. A laser cutter/engraver uses a laser light (1) focused on a material to vaporize material at a high temperature (1).</p> <p style="padding-left: 40px;">3D printer. A 3D printer constructs a solid object from thousands of slices (1). Those layers bonded together to form a solid object (1).</p> <p style="padding-left: 40px;">Accept any other appropriate responses. i.e. particle dust.</p>			

		AO3	AO4	Mark
(b)	State an appropriate CAM machine for the batch manufacture of this decoration and explain the advantages and disadvantages of your selected machine.		✓	4
	<p><i>The response must name a CAM machine and explain advantages and disadvantages of the selected CAM machine.</i></p> <p>Guidance to markers</p> <p><i>Incorrect/no response. 0 mark</i></p> <p><i>Candidates need to address both advantages and disadvantages to achieve full marks.</i></p> <p><i>If a candidate lists each response you may award. 1 mark</i></p> <p><i>If a candidate elaborates each response you may award. 2 marks</i></p> <p><i>Maximum of 3 marks if the advantages or disadvantages are solely listed.</i></p> <p>Laser Cutter (one advantage and one disadvantage 1 mark for each) Laser produces little waste material reducing material costs. Laser will accurately produce the desired design. Laser produces a burnt edge that will need further finishing before sale. When programmed lasers can reproduce the same shape many times relatively quickly.</p> <p>OR</p> <p>CNC Router (one advantage and one disadvantage 1 mark for each) A router will produce a decoration with clean edges saving finishing time. A router will produce more waste in the form of sawdust increasing material costs. A router will have a radius on all internal corners and is less accurate. When programmed routers can reproduce the same shape many time.</p> <p><i>Accept any other appropriate response.</i></p>			

Q2	Working in a manufacturing environment can be a hazardous activity and as a result suitable safe working practices must be employed.			
		AO3	AO4	Mark
(a)	Explain the meaning of the sign shown below.		✓	2
	<p><i>The response must state that the yellow triangle is a warning sign. The flames indicate a flammable material.</i></p> <p><i>Incorrect/no response.</i> 0 Mark</p> <p><i>Identification of the warning sign.</i> 1 Mark</p> <p><i>Identification of flammable material.</i> 1 Mark</p>			
		AO3	AO4	Mark
(b)	Write a detailed risk assessment for a machine or piece of equipment you have used.		✓	6
	<p><i>The response must state the equipment or machine being used.</i></p> <p>Guidance to markers</p> <p><i>Incorrect/no response.</i> 0 mark</p> <p><i>One mark can be awarded if the candidate mentions the use of or reference to the five step risk assessment.</i> 1 mark</p> <ul style="list-style-type: none"> • Identify the hazard 1 mark <i>Examples:</i> Hand contact with sanding belt when in use. Entanglement in belt when in use. Dust. Material Jamming/wedging in moving parts. Check machine. • Decide who might be harmed 1 mark <i>Examples:</i> User/Individual operating the equipment. Individuals in close proximity of the equipment. • Evaluate the risk and establish precautions/best practice 1 mark <i>Examples:</i> Chance of hand contact, Individuals given clear instructions and demonstrations. Face guards to be used. Entanglement when in use, Individual use PPE, Hair tied back, jewellery/lose items removed. Material jamming, Individuals given clear instruction on the safe use/best practice with machine. • Record any significant findings 1 mark <i>Examples:</i> Identify any issues following the assessment being carried out on the Linisher/Sander. Complete a record of any incidents that have occurred on the linisher/Sander. • Review the risk assessment and update if required 1 mark Review use of linisher/sander annually. Review use of linisher/sander following an accident. <p><i>Accept any other appropriate response.</i></p>			

Q3	Products are often manufactured from a range of individual components. Study the photographs below of a stackable chair.			
		AO3	AO4	Mark
(a)	State a possible method of manufacture for the seat and shaping the legs.		✓	2
	<p><i>Each response must name a process used: 1 mark for each appropriate response.</i></p> <p>Guidance to markers</p> <p><i>Incorrect/no response. 0 mark</i></p> <p>Seat Responses may include injection moulding or compression moulding. 1 mark</p> <p>Shaping the legs. Responses may include: Bent around former or jig. 1 mark</p> <p><i>Accept any other appropriate response.</i></p>			
		AO3	AO4	Mark
(b)	The seat and frame will need to be joined to form a functioning chair. Using notes and sketches explain and justify a suitable fixing method.		✓	6
	<p><i>Response must demonstrate a clear understanding of a suitable method of joining dissimilar materials together, suitable illustrations and justified comments.</i></p> <p><i>i.e. riveting, mechanical nut and bolt, self-tapping screw.</i></p> <p>Guidance to markers</p> <p><i>No supporting illustration/sketch max 3 Marks.</i></p> <p>Brief description: 1-2 Marks The mild steel legs could be attached to the plastic seat using a series of rivets, these could be quickly and easily used in the assembly line/process. Simple diagram with no supporting notes.</p> <p>More Detailed description: 3-4 Marks The plastic/polymer seat could be attached to the formed mild steel legs using a series of cold/Pop rivets. This semi-permanent method/process is suitable because it could be carried out on a production/Assembly line by unskilled workers and is a quick easy method to attach dissimilar materials using standard fixing components. Simple diagram with supporting notes.</p> <p>Detailed and justified description: 5-6 Marks The plastic/polymer seat could be attached to the formed mild steel legs using a series of cold/pop rivets. This semi-permanent method/process is suitable because it could be carried out on a production/Assembly line by unskilled workers and is a quick easy method to attach dissimilar materials using standard fixing components. Using this method avoids the use of any additional heat which could melt a thermoplastic seat. A semi-permanent joint like a pop-rivet is suitable as it will allow for replacement either the chair or leg component if they are damaged or fail during the life of the product.</p>			

Q4	Polymers are materials that are widely used in many every day products and toys.			
		AO3	AO4	Mark
	Evaluate the characteristics and physical properties of ABS and rubber that make it suitable for the toy shown in the photographs above.	✓		8
<p>Guidance to markers</p> <p><i>Focus of the response should be on the characteristics and properties of ABS and rubber and their relevance to the function and form of the lego elements.</i></p> <p>Characteristics are the elements a designer can influence or change in the product/material.</p> <p>ABS</p> <ul style="list-style-type: none"> • ABS liquefy which allows it to be easily <i>manufactured through an injection moulding process</i> and then subsequently recycled. • Complex shapes can be formed. • <i>Self-finished face, the surface is as good as the mould no secondary finishing needed.</i> <p>Rubber</p> <ul style="list-style-type: none"> • <i>Can be moulded into a suitable shape.</i> • <i>Has a high level of surface friction.</i> <p>Property is the distinguishing features of a materials behavior.</p> <p>ABS</p> <ul style="list-style-type: none"> • Acrylonitrile Butadiene Styrene (ABS) is an opaque thermoplastic. • ABS are impact resistance and toughness. • <i>Easy to colour, bright colours make it suitable for a child's toy.</i> • <i>Flexible and will allow for the friction fit.</i> • <i>ABS is durable, the bricks can be repositioned many times without being damaged.</i> • <i>Non-toxic.</i> • <i>Water proof.</i> <p>Rubber</p> <ul style="list-style-type: none"> • <i>Tensile strength it can be stretched over the wheel.</i> • <i>Elasticity it will return to its original shape without heating.</i> • <i>It is durable.</i> • <i>Water proof.</i> <p>PC (polycarbonate) for transparent bricks, as ABS can't be made transparent. Polycarbonate parts on the other hand have too much friction when in contact with other polycarbonate parts, making them extremely hard to disassemble.</p> <p>Both materials must be addressed for the full 8 marks.</p>				

Q5	The phrase 'Form follows Function' has become the belief of many designers in the 20 th and 21 st century.	AO3	AO4	Mark
	Discuss this statement with reference to the work of James Dyson.		✓	8
	<p><i>Student response must demonstrate understanding of the work of James Dyson and how it relates to the question.</i></p> <p>Responses must make reference to at least one of Dysons products.</p> <p>Examples:</p> <ul style="list-style-type: none"> • James Dyson's upright vacuum cleaner and air blade were innovative developments in the market and displayed this with new and innovative forms, these forms helped to identify the different elements and functions of products. • Simple elements used in the development of his CSYS task lights. • The use of the cyclone technology was his big innovation and this was celebrated in the design in the form of a clear collection tube allowing the user to see the cyclone in action. • The shape of the air blade required users to place hands vertically into the air flow. • With the original Dyson DC01 the general form for the vacuum was more traditional with a round cylindrical body containing the cyclone and a flat wedge-shaped head with small wheels at the back. Many of the functioning elements that were later to be celebrated were hidden. • The use of bright colours allowed Dyson to visually break up the form of what was a more traditional looking product i.e. Vacuum, the washing Machine, Air blade. The use of injection moulding ABS polymer and polycarbonate parts has allowed Dyson to develop and greatly refine this initial design a range whose forms respond to the function of the component parts, and this is emphasized by his use of bright eye-catching colours as in his vacuum, air blade and hair care products. • The cyclone that developed the powerful suction was housed above a set of filters that help deposit the dust and dirt into a clear transparent cylindrical chamber. • The user is able to see when the dust chamber is full and needs to be emptied this allows the vacuum to function as efficiently as possible providing the user is prepared to empty it. • The functioning elements of the vacuums have become more evident as Dyson has developed his range. With the Dyson Ball the function of the different elements in the vacuum have been reflected in the form of the vacuum as a whole and the smaller components, the large ball has allowed the vacuum to be much more manoeuvrable as well as lowering the centre of gravity (the whole form looks heavy at the bottom with the large ball base). • Using the ball in the base allows improved function as the ball has increased the manoeuvrability of the vacuum and the use of a large number of smaller cyclones has been reflected in the cluster of cyclones at the top of the collection cylinder. • The cyclones responsible for its powerful, suction remain housed above the filters and deposit dust and dirt into the ever-present clear transparent chamber. • The Dyson vacuum cleaner, air blade, Fans, hair care and lights all have a functional aesthetic that looks interesting and highlights the different functional elements in the design. 			

	<p>Guidance to markers</p> <p><i>Focus of the response should be on James Dyson products their function and form.</i></p> <p><i>Incorrect/no response.</i> 0 Mark</p> <p>Level 1 1-2 Marks</p> <ul style="list-style-type: none"> • The candidate has a simplistic knowledge of the issues associated with the question. • Limited use of terminology and technical language. • The candidate has limited knowledge of the aesthetic qualities of the product and/or consideration for the user in their design. • The candidate will express basic ideas clearly, if not always fluently. Answers may deviate from the question or not be relevant. • Grammar, punctuation and spelling may be weak impacting on effective communication. <p>Level 2 3-4 Marks</p> <ul style="list-style-type: none"> • The candidate has a basic understanding of the issues associated with the question. • Satisfactory use of terminology and technical language. • The candidate has some general knowledge of the aesthetic qualities and consideration for the user in the design aspects, but they are not always considered in detail. • The candidate will express straightforward ideas clearly, if not always fluently. Answers may deviate from the question or be weakly presented. • There may be some errors of grammar, punctuation and spelling but is still able to communicate the issues. <p>Level 3 5-6 Marks</p> <ul style="list-style-type: none"> • The candidate demonstrates a clear understanding of the issues associated with the question. • Good use of terminology and technical language. • The candidate has demonstrated real knowledge about the aesthetic qualities, linked to James Dyson's philosophies. There are descriptive comments about some elements of the needs of the end user. • The candidate will express moderately complex ideas clearly and fluently, through well-linked sentences and paragraphs. Answers will be generally relevant and structured. • There may be occasional errors of grammar, punctuation and spelling. <p>Level 4 7-8 Marks</p> <ul style="list-style-type: none"> • The candidate demonstrates a specific ability to analyse questions, takes into account a wide range of factors and has a clear understanding of the issues associated with the question. • Very good use of terminology and technical language. • The candidate has demonstrated detailed knowledge about the aesthetic qualities, linked to James Dyson's philosophies. There are detailed descriptive comments about specific elements of the needs of the end user. • The candidate will express complex ideas extremely fluently. Sentences and paragraphs will follow on from each other smoothly and logically. Answers will be consistently relevant and structured. • There will be few, if any, errors of grammar, punctuation and spelling. 	
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Q6	Household appliances often reflect the audience they have been designed for. Study the two images below.	AO3	AO4	Mark
(a)	The starting point for a designer is a product analysis. Write a critical analysis of one of the products pictured above, justify each observation.	✓		8
<i>The response must contain justified observations.</i>		0 Mark		
<i>Incorrect/no response.</i>				
<i>Identification of suitable comments.</i>				
Telephone A				
<i>Handset is attached to the telephone so the user cannot move away from the phone when using it.</i>				
<i>Limited number of functions on the telephone so the user would purchase additional units for the caller display, answer phone.</i>				
<i>Good contrast between buttons and telephone so it could be used by partially sighted person.</i>				
<i>Large buttons for functions and numbers would allow for use by elderly.</i>				
<i>Limited range of functions would make it easy to use.</i>				
<i>Dated design, would not appeal to younger 'on trend' individuals.</i>				
OR				
Telephone B				
<i>Handset is not attached to the telephone so the user can move away from the phone when using it.</i>				
<i>Wide number of functions on the telephone so no requirement for the user to purchase additional units for the caller display, answer phone.</i>				
<i>Button light when using the phone buttons so it could be used by partially sighted person.</i>				
<i>Small buttons for functions and numbers could be difficult for elderly of disabled users.</i>				
<i>Wide range of functions some of which may be difficult to set up and use.</i>				
Maximum of 4 marks for 4 points only.				
<i>Accept any other appropriate response.</i>				

		AO3	AO4	Mark
(b)	Write four fully justified specification points that will ensure the requirements of the user are met.		✓	8
	<p>The response must use four justified points:</p> <p>Examples;</p> <ul style="list-style-type: none"> • The handset must have good colour contrast for the ease of use for the visually impaired user. • The hand set must look modern and stylish to allow the user to have 'on trend' items in their home. • The handset must clearly identify the key interfaces of mouth piece and ear piece to avoid any confusion when answering the phone. • Comfortable to hold while it is in use so it can be used for longer periods of time. • The device must be suitable for both left and right-handed users this will be cheaper for the manufacturer and does not discriminate between users. The device must be suitable for mass production to allow for thousands to be manufactured. • The device must be designed using standard parts to reduce costs. <p>Guidance to markers</p> <p>Minimum of 4 specification points explained. It must..... or It should or It could</p> <p>Accept any justified specification point that is relevant.</p> <p><i>Incorrect/no response.</i> 0 mark</p> <p>A relevant point that has not been justified. 1 mark</p> <p>A Justified specification point that is relevant. 2 marks</p> <p><i>Accept any other appropriate response.</i></p>			

(c)		AO3	AO4	Mark
	In the space provided produce a possible design for the handset. You are required to use a combination of 2D and 3D freehand drawings.		✓	16
	<p>(i) An annotated design proposed that displays evidence of your consideration of user interface, function and style. <i>The response must contain a possible design for the handset. You are required to use a combination of 2D and 3D freehand drawings. Together with evidence of consideration of user interface, function and style.</i></p> <p><i>Incorrect/no response.</i> 0 mark</p> <p>D2 or 3D images that have very little detail or supporting annotation. 1-2 marks</p> <p>Idea developed with both 2D and 3D illustrations, some supporting annotation that is relevant to the user interface, function and style. 3-4 marks</p> <p>Ideas developed with both 2D and 3D illustrations, supporting annotation is relevant to the design and indicates a clear understanding of the problem. 5-6 marks</p> <p>Ideas developed with both 2D and 3D illustrations, supporting annotation is relevant to the designs user interface, function and style which demonstrates a detailed understanding of the problem. 7-8 marks</p> <p>(ii) Labelling and justifying the use of materials in your design.</p> <p>Polypropylene plastic, ABS, silicon, Poly Carbonate, rubber, etc.</p> <p>Properties/Characteristics:</p> <ul style="list-style-type: none"> • We are expecting the candidates to mention • Range of colours. • Finishing. • Recyclability. • Toughness. • Electrical insulation. • Weight. • Flexibility. • Resistant to corrosion. • Texture. <p>Guidance to markers</p> <p>No mention of specific materials characteristics or properties. 0 Mark</p> <p>Very little detail or justification of material selection. 1 Mark</p> <p>Materials named for the product that includes one or two characteristics or properties. 2 Marks</p> <p>Materials named for the product that includes two or three characteristics or properties. 3 marks</p> <p>Detailed description of named materials for the product that includes four or characteristics or properties. 4 marks</p>			

	<p>(iii) The quality/presentation and communication of your 2D/3D drawings. <i>There MUST be a mixture of 2D and 3D design sketches generated. Sketches should include annotation. Candidates are not expected to render, colour or shade your design work.</i></p> <p>Guidance to markers</p> <p>The emphasis is on the quality of communication and presentation of design ideas.</p> <p>2D or 3D images that have very little detail or supporting annotation. 1 mark</p> <p>Idea developed with both 2D and 3D illustrations, some supporting annotation that is relevant to the design. 2 marks</p> <p>Ideas developed with both 2D and 3D illustrations, supporting annotation is relevant to the design and indicates a clear understanding of the problem. 3 marks</p> <p>Ideas developed with both 2D and 3D illustrations, supporting annotation is relevant to the design and indicates a detailed understanding of the problem. 4 marks</p>	
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(d)		AO3	AO4	Mark
	Justify how your design meets the four points indicated in your design specification.		✓	8
	<p><i>Candidates must be able to link the design they have produced to their specification.</i></p> <p><i>Each specification point must be identified in the design with clear explanation of how it meets the design specification.</i></p> <p>The candidate must write four justified points.</p> <p>Examples:</p> <ul style="list-style-type: none"> • The handset must have good colour contrast for the ease of use for the visually impaired user This has been carried out through the use of dark grey ABS for the keys in contrast to the white of the hand set. • The hand set must look modern and stylish to allow the user to have 'on trend' items in their home. The design has been based on the work of..... • The handset must clearly identify the key interfaces of mouth piece and ear piece to avoid any confusion when answering the phone. This has been achieved through the use of textured surfaces on the area that is held. • Comfortable to hold while it is in use so it can be used for longer periods of time. This has been achieved through the use of a silicone/rubber/textured surface that the user holds when operating the phone. <p>Guidance to markers</p> <p><i>Incorrect/no response</i> 0 mark</p> <p>A relevant point that has not been linked to the design or justified. 1 mark</p> <p>A Justified specification point that is linked to the design or justified. 2 marks</p>			